WFIRST IFU
-- Preliminary “existence proof”

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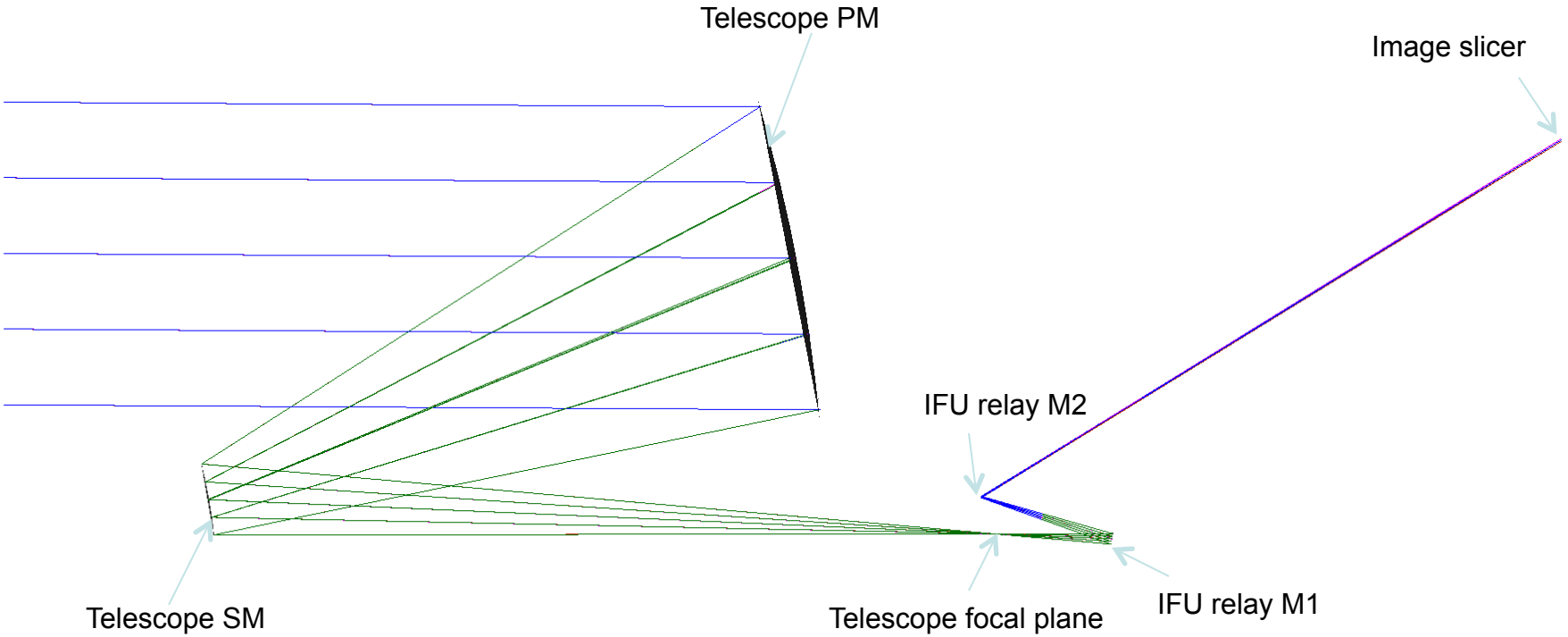
summary

- Started work last summer on an existence proof IFU for IDRM
- Could work equally well for DRM1 or DRM2
- This is based on GSFC IRD work and we are not discussing the imager slicer technology here
  - However this is working now in the lab and other flight concepts are progressing other science areas
  - Prior work has also shown that we can accommodate other concepts, e.g. CNES IFU could fit in the Probe
- Basic capability is 36x36 spectra of adjacent 0.1”x0.1” slices of the field of view
- Telescope aberrations are corrected before imager slicer
- Prism spectrograph, notionally 0.6-2.4um range
- HdCdTe focal plane (H1RG has enough pixels, could also use H2 or H4)

WFIRST Telescope and IFU Relay Optics

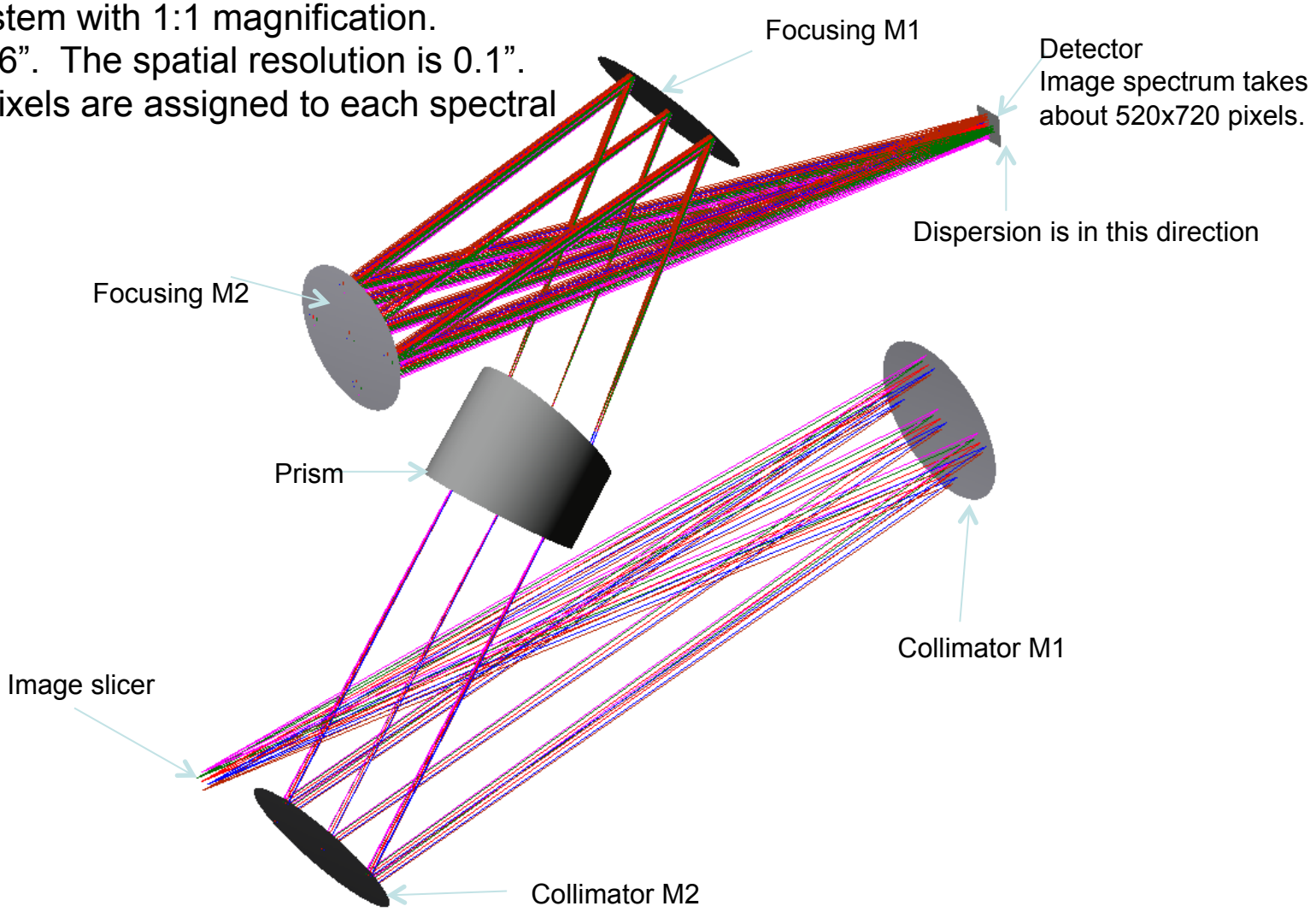
Optical system has 3 sections – common telescope optics {PM & SM}, magnifying relay optics, and IFU {imager slicer plus spectrograph}

Magnification from telescope focal plane to Mirror array: 31.5x to fit image slice size of 0.45mm x 0.45mm. The size selection is based on detector pixel size, 1:1 magnification, and spectral resolution.



WFIRST IFU Layout

IFU is an f/7 system with 1:1 magnification.
FOV is 3.6” x 3.6”. The spatial resolution is 0.1”.
Three rows of pixels are assigned to each spectral line.

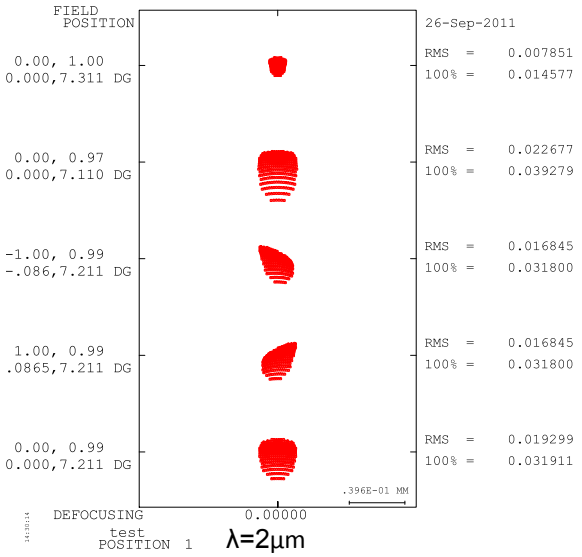


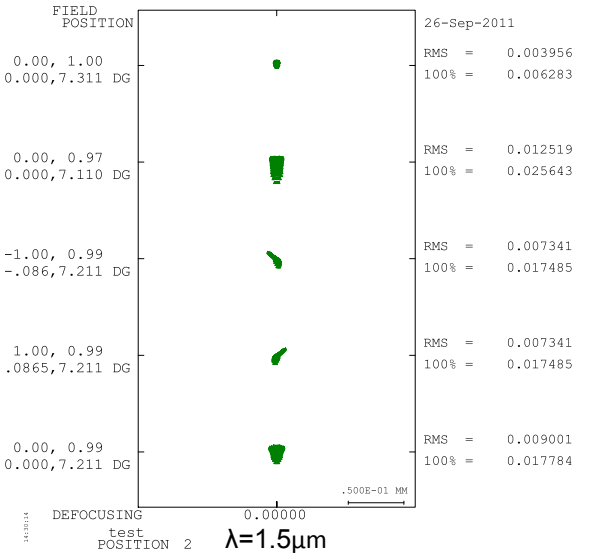
Initial layout was 0.6-2.0um for IDRM; we think it is extendable to 2.4um

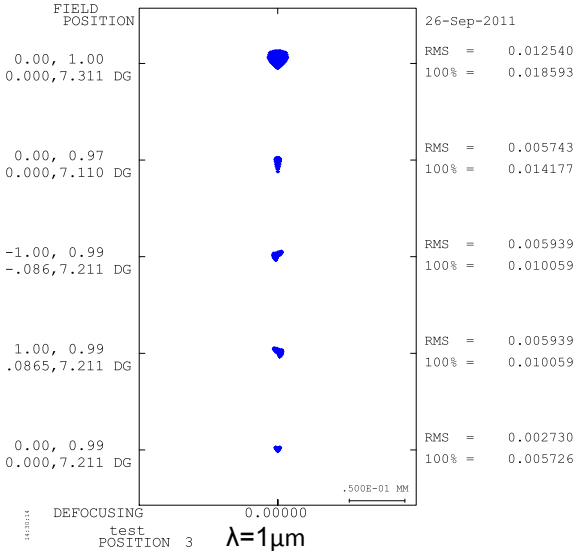
Backup

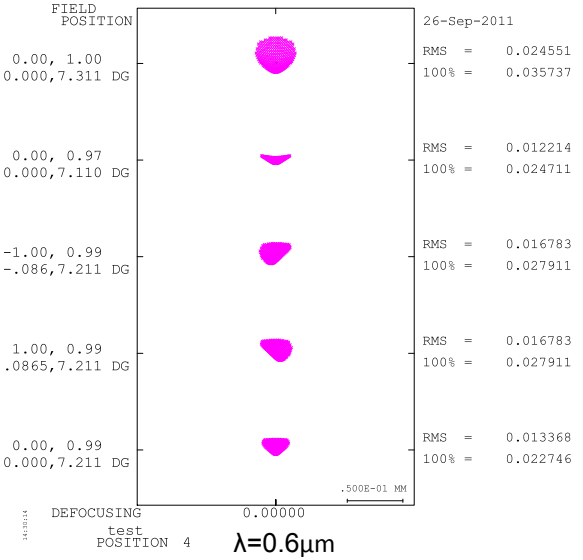
- Design performance [spot diagrams]
- Comments on design

Spot Diagram of 4 wavelengths

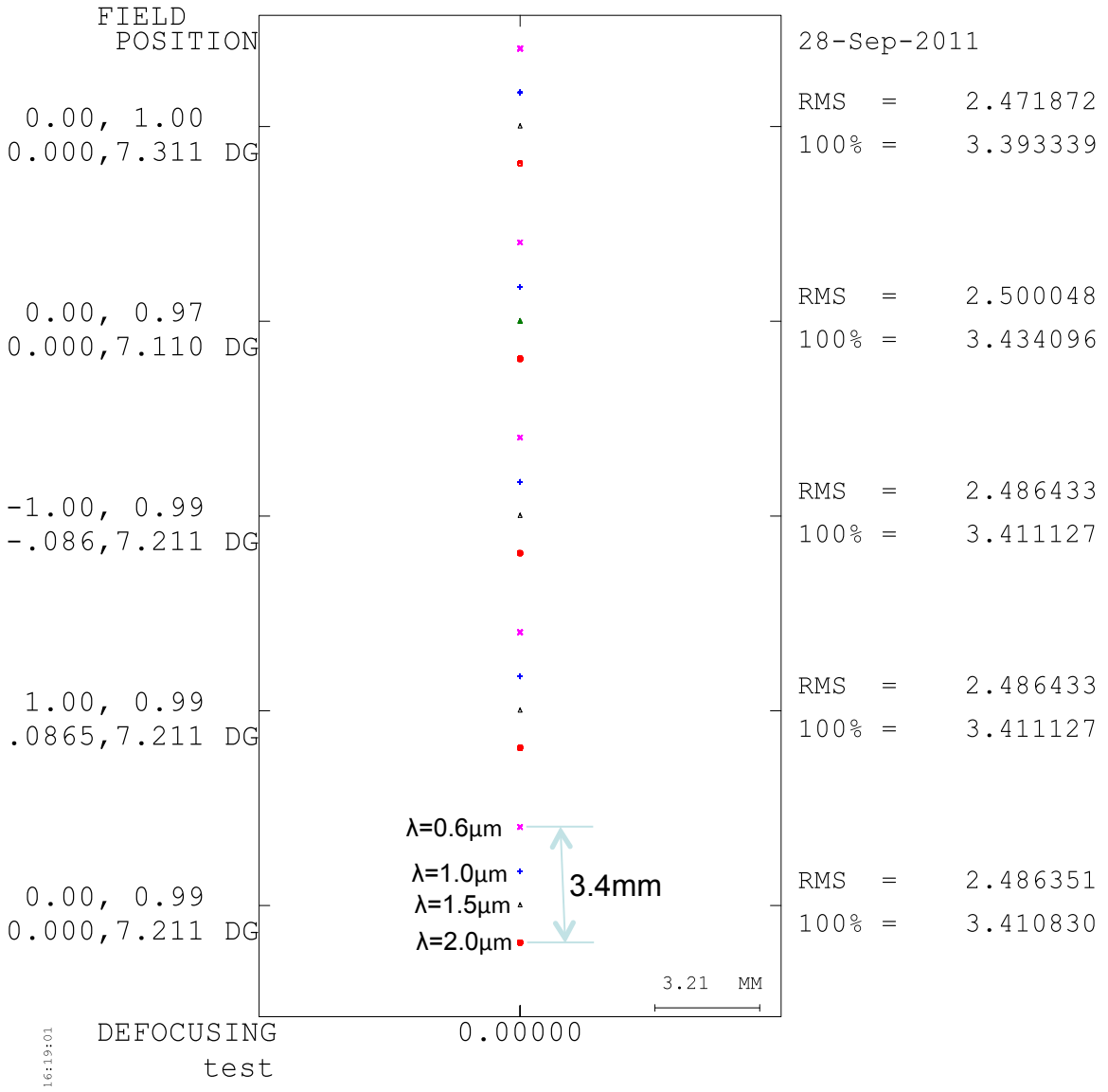








Spot Diagram



Summary

- The preliminary design shows that IFU can meet the specification: 3.6” x 3.6” FOV with 0.1” resolution; R=75 spectral resolution
- The IFU unit was designed separately, because CODEV (or Zemax) image slicer does not consider the diffraction effect. The beams after the slicer should be F/7, but in a geometric ray trace the f/# is very large.
- The Telescope + relay + IFU will be combined using Zemax. It may not provide accurate image analysis, but provide CAD model for packaging.